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ELECTROTECHNICAL VOCABULARY

PART LII DATA PROCESSING

Section 2 Arithmetic and Logic Operations

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ELECTROTECHNICAL VOCABULARY

PART LII DATA PROCESSING

Section 2 Arithmetic and Logic Operations

0. FOREWORD

0.1 This Indian Standard (Part LII/Sec 2) was adopted by the Indian Standards Institution on 15 September 1980, after the draft finalized by the Basic Standards on Electronics and Telecommunication Sectional Committee, in consultation with Computers Business Machines and Calculators Sectional Committee, had been approved by the Electronics and Telecommunication Division Council.

0.2 Electronic data processing is utilized for numerous exchanges and analysis of information of both intellectual and material nature. Application of electronic data processing becomes difficult, either because of the great variety of terms used in various fields to express the same concept, or because of the absence of, or the imprecision of useful concepts. To overcome these barriers, this standard has been formulated.

0.3 This standard is one of the series of twenty Indian Standards on data processing vocabulary, constituting Part LII of the electrotechnical vocabulary, which deals with the main areas of data processing classified under the following heads:

Section 1	Fundamental terms
Section 2	Arithmetic and logic operations
Section 3	Equipment technology
Section 4	Organization of data
Section 5	Representation of data
Section 6	Preparation and handling of data
Section 7	Digital computer programming
Section 8	Control, input-output and arithmetic equipment
Section 9	Data media, storage and related equipment
Section 10	Data communications
Section 11	Operating techniques and facilities

Section 12 Information theory
Section 13 Analogue and hybrid computing
Section 14 Computer graphics and computer micrographics
Section 15 Programming languages
Section 16 Data bases
Section 17 Data structures
Section 18 Information systems characteristics and development
Section 19 Reliability, maintenance and availability
Section 20 Control and integrity

0.4 Prime importance has been given to simplicity and clarity of the definitions so that they may be understood by all. It may, therefore, be felt that some definitions do not cover all the cases and exceptions.

0.5 Assistance has been derived in formulating this standard from International Standard ISO 2382/II-1976 Data processing — Vocabulary — Section 02 : Arithmetic and logic operations, prepared by the International Organization for Standardization.

1. SCOPE

1.1 This standard (Part LII/Sec 2) covers terms related to arithmetic and logic operations as used in data processing.

2. METHODS

2.1 Heuristic Method — Any exploratory method of solving problems in which an evaluation is made of the progress towards an acceptable final result using a series of approximate results, for example, by a process of guided trial and error.

2.2 Mathematical Induction — A method of proving a statement concerning terms based on natural numbers not less than N by showing that the statement is valid for the term based on N and that, if it is valid for an arbitrary value of n that is greater than N, it is also valid for the term based on $(n + 1)$.

2.3 Formal Logic — The study of the structure and forms of valid argument without regard to the meaning of the terms in the argument.

2.4 Symbolic Logic/Mathematical Logic — The discipline in which valid argument and operations are dealt with using an artificial language designated to avoid the ambiguities and logical inadequacies and natural languages.

3. REPRESENTATIONS OF VARIABLES

3.1 Switching Variable/Logic Variable — A variable that may take only a finite number of possible values or states.

Example:

An unspecified character of a character set.

3.2 Argument

a) An independent variable.

b) Any value of an independent variable.

Example:

A search key; a number identifying the location of an item in a table.

3.3 Parameter — A variable that is given a constant value for a specified application and that may denote the application.

3.4 Scalar — A quantity characterized by a single value.

3.5 Vector — A quantity usually characterized by an ordered set of scalars.

3.6 Span/Range — The difference between the highest and the lowest values that a quantity or function may take.

3.7 Characteristic (of a Logarithm) — The integer part, which may be positive or negative, of the representation of a logarithm.

3.8 Mantissa (of a Logarithm) — The non-negative fractional part of the representation of a logarithm.

4. NUMBERS

4.1 Natural Number/Non-negative Integer — One of the numbers zero, one, two,...

NOTE — Some people define natural numbers as starting at one rather than zero.

4.2 Integer/Integer Number — One of the numbers zero, plus one, minus one, plus two, minus two,...

4.3 Real Number — A number that may be represented by a finite or infinite numeral in a fixed radix numeration system.

4.4 Rational Number — A real number that is the quotient of an integer divided by an integer other than zero.

4.5 Irrational Number — A real number that is not a rational number.

4.6 Complex Number — A number consisting of an ordered pair of real numbers, expressible in the form $a + bi$, where a and b are the real numbers and $i^2 = -1$.

4.7 Random Number — A number selected from a known set of numbers in such a way that each number in the set has the same probability of occurrence.

4.8 Random Number Sequence — A sequence of numbers each of which cannot be predicted only from a knowledge of its predecessors.

4.9 Pseudo-Random Number Sequence — A sequence of numbers that has been determined by some defined arithmetic process but is effectively a random number sequence for the purpose for which it is required.

4.10 Serial Number — An integer denoting the position of an item in a sequence.

4.11 Zero (in Data Processing) — The number that when added to or subtracted from any other number does not alter the value of that other number.

NOTE — Zero may have different representations in computers such as positively or negatively signed zero (which may result from subtracting a signed number from itself) and floating-point zero (in which the fixed point part is zero, while the exponent in the floating-point representation may vary).

4.12 Binary (Ternary) (Octal) (Decimal or Denary) (Duodecimal) (Sexadecimal or Hexadecimal) (N-ary)

a) Characterized by a selection, choice or condition that has two (three) (eight) (ten) (twelve) (sixteen) (N) possible different values or states.

b) Of a fixed radix numeration system, having a radix of two (three) (eight) (ten) (twelve) (sixteen) (N).

4.13 Factorial — The product of the natural numbers 1, 2, 3,......, up to and including a given integer.

5. FUNCTIONS AND MAPPING

5.1 Switching Function/Logic Function — A function that has only a finite number of possible values and whose independent variables each has only a finite number of possible values.

5.2 Boolean Function — A switching function in which the number of possible values of the function and of each of its independent variables is two.

5.3 Recursively Defined Sequence — A sequence of terms in which each term after the first is determined by an operation in which the operands include some or all of the preceding terms.

NOTE — In a recursively defined sequence; there may exist a finite number of non-defined terms, possibly greater than one.

5.4 To Map (Over) — To establish a set of values having a defined correspondence with the quantities or values of another set.

Example:

To evaluate a mathematical function, that is, to establish the values of the dependent variable, for those values of the independent variable or variables that are of immediate concern.

5.5 Map/Mapping — A set of values having defined correspondence with the quantities or values of another set.

5.6 Generating Function — Of a given series of functions or constants, a mathematical function that, when represented by an infinite series, has those functions or constants as coefficients in the series.

Example:

The function $(1 - 2ux + u^2)^{-1/2}$ is a generating function of the Legendre polynomials $P_n (x)$ by virtue of the expansion

$$(1 - 2ux + u^2)^{-1/2} = \sum_{n=0}^{\infty} P_n (x) u^n$$

5.7 Threshold Function — A two-valued switching function of one or more not necessarily Boolean arguments that takes the value one if a specified mathematical function of the arguments exceeds a given threshold value and zero otherwise.

Example:

The threshold function:

$$f (a_1 \ldots\ldots, a_n) = 0 \text{ if } g \leqslant T$$
$$f (a_1 \ldots\ldots, a_n) = 1 \text{ if } g > T$$
$$\text{with } g = W_1 a_1 + \ldots\ldots + W_n a_n$$

where $W_1 \ldots\ldots, W_n$ are positive weights for the real arguments $a_1 \ldots\ldots, a_n$ and T is the threshold.

6. BOOLEAN OPERATIONS

6.1 Boolean Operation/Binary Operation

a) Any operation in which each of the operands and the result take one of two values.

NOTE 1 — The term binary operation is deprecated to avoid confusion with dyadic operation and with binary arithmetic operations.

NOTE 2 — In order to simplify the definitions of individual Boolean operations in this sub-section of the Vocabulary, and to simplify the table at the end of this section, the two Boolean values are referred to as 'Boolean value 0' and 'Boolean value 1'. Other pairs of values might be used without being in contradiction with the definitions.

b) An operation that follows the rules of Boolean algebra.

6.2 Dyadic (*N*-Adic) Boolean Operation/Binary (*N*-Ary) Boolean Operation — A Boolean operation on two and only two (on *N* and only *N*) operands.

6.3 Boolean Operator — An operator each of whose operands and whose result take one of two values.

6.4 Complementary Operation — Of a Boolean operation, another Boolean operation whose result, when it is performed on the same operands as the first Boolean operation, is the negation of the result of the first Boolean operation.

Example:

Disjunction is the complementary operation of non-disjunction.

6.5 Dual Operation — Of a Boolean operation, another Boolean operation whose result, when it is performed on operands that are the negation of the operands of the first Boolean operation, is the negation of the result of the first Boolean operation.

Example:

Disjunction is the dual operation of conjunction.

6.6 Identity Operation — The Boolean operation whose result has the Boolean value 1 if and only if all the operands have the same Boolean value.

NOTE — An identity operation on two operands is an equivalence operation.

6.7 Non-identity Operation — The Boolean operation whose result has the Boolean value 1 if and only if all the operands do not have the same Boolean value.

NOTE — A non-identity operation on two operands is a non-equivalence operation.

6.8 Equivalence Operation/IF-AND-ONLY-IF Operation (IFF) — The dyadic Boolean operation whose result has the Boolean value 1 if and only if the operands have the same Boolean value.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.9 Non-Equivalence Operation/EXCLUSIVE-OR Operation/Modulo Two Sum/Addition Without Carry — The dyadic Boolean operation whose result has the Boolean value 1 if and only if the operands have different Boolean values.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.10 Conjunction/AND Operation/Inspection/Logical Product — The Boolean operation whose result has the Boolean value 1 if and only if each operand has the Boolean value 1.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.11 Non-Conjunction/NAND Operation/NOT-BOTH Operation/NOT-AND Operation — The dyadic Boolean operation whose result has the Boolean value 0 if and only if each operand has the Boolean value 1.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.12 Disjunction/OR Operation/INCLUSIVE-OR Operation/Logical Add/Logical Sum/EITHER-OR Operation — The Boolean operation whose result has the Boolean value 0 if and only if each operand has the Boolean value 0.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.13 Non-Disjunction/NOR Operation/NEITHER-NOR Operation/NOT-OR Operation — The dyadic Boolean operation whose result has the Boolean value 1 if and only if each operand has the Boolean value 0.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.14 Exclusion/NOT-IF-THEN Operation/AND-NOT Operation/EXCEPT Operation — The dyadic Boolean operation whose result has the Boolean value 1 if and only if the first operand has the Boolean value 1 and the second has the Boolean value 0.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.15 Implication/IF-THEN Operation/Conditional Implication (Operational)/Inclusion — The dyadic Boolean operation whose result has the Boolean value 0 if and only if the first operand has the Boolean value 0 and the second has the Boolean value 1.

NOTE — *See also* the table of Boolean operations at the end of this section.

6.16 Negation/NOT Operation/Boolean Complementation/Inversion — The monadic Boolean operation whose result has the Boolean value opposite to that of the operand.

NOTE — *See also* the table of Boolean operations at the end of this section.

7. PRECISION, ACCURACY AND ERRORS

7.1 Precision — A measure of the ability to distinguish between nearly equal values.

Example:

Four-place numerals are less precise than six-place numerals; nevertheless a properly computed four-place numeral may be more accurate than an improperly computed six-place numeral.

7.2 Multiple-Precision — Characterized by the use of two or more number of bits that are normally used to represent a number of enhancing precision.

7.3 Single (Double) (Triple) Precision — Characterized by the use of one (two) (three) number of bits that are normally used to represent a number of enhancing precision.

7.4 Error — A discrepancy between a computed, observed or measured value or condition and the true, specified or theoretically correct value or condition.

7.5 Accuracy

a) A quality of that which is free of error.

b) A qualitative assessment of freedom from error, a high assessment corresponding to a small error.

c) A quantitative measure of the magnitude of error, preferably expressed as a function of the relative error, a high value of this measure corresponding to a small error.

7.6 Absolute Error — The algebraic result of subtracting a true, specified or theoretically correct value from the value computed, observed, measured or achieved.

7.7 Relative Error — The ratio of an absolute error to the true, specified or theoretically correct value of the quantity that is in error.

7.8 Balanced Error — A set of errors whose mean value is zero.

7.9 Bias — A systematic deviation of a value from a reference value.

7.10 Bias Error — An error due to bias.

Example 1:

The error caused by a shrunken measuring tape.

Example 2:

In computation, an error caused by truncation.

7.11 Error Range — The set of values that an error may take.

7.12 Error Span/Error Range — The difference between the highest and the lowest error values.

7.13 Truncation Error — An error due to truncation.

7.14 Rounding Error — An error due to rounding.

8. ARITHMETIC OPERATIONS

8.1 Binary Arithmetic Operation/Binary Operation — An arithmetic operation in which the operands and the result are represented in the pure binary numeration system.

NOTE — The term binary operation is deprecated to avoid confusion with dyadic operation and with Boolean operation.

8.2 Significant Digit Arithmetic — A method of making calculations using a modified form of floating-point representation system in which the number of significant digits in each operand is indicated and in which the number of significant digits in the result is determined with reference to the number of significant digits in the operands, to the operation performed, and to the degree of precision available.

8.3 (Arithmetic) Overflow — The portion of a numeric word expressing the result of an arithmetic operation by which its word length exceeds the word length provided for the number representation.

8.4 Overflow — That portion of a word expressing the result of an operation by which its word length exceeds the storage capacity of the intended storage device.

8.5 (Arithmetic) Underflow — In an arithmetic operation, a result whose absolute value is too small to be represented within the range of the numeration system in use.

Example 1:

The condition existing, particularly when a floating-point representation system is used, when the result is smaller than the smallest non-zero quantity that can be represented.

Example 2:

The result may underflow because of the generation of a negative exponent that is outside the permissible range.

8.6 Carry Digit — A digit that is generated when a sum or a product in a digit place exceeds the largest number that can be represented in that digit place and that is transferred for processing elsewhere.

NOTE — In a positional representation system, a carry digit is transferred to the digit place with next higher weight for processing there.

8.7 Carry — The action of transferring a carry digit.

8.8 End-Around Carry — The action of transferring a carry digit from the most significant digit place to the least significant digit place.

Example:

An end-around carry may be necessary when adding two negative numbers that are represented by their diminished radix complements.

8.9 Borrow Digit — A digit that is generated when a difference in a digit place is arithmetically negative and that is transferred for processing elsewhere.

NOTE — In a positional representation system, a borrow digit is transferred to the digit place with next higher weight for processing there.

8.10 End-Around Borrow — The action of transferring a borrow digit from the most significant digit place to the least significant digit place.

9. OPERATOR NOTATIONS IN MATHEMATICS

9.1 Infix Notation — A method of forming mathematical expressions, governed by rules of operator precedence and using paired delimiters such as parentheses, in which the operators are dispersed among the operands, each operator indicating the operation to be performed on the operands or the intermediate results adjacent to it.

Example 1:

A added to B and the sum multiplied by C is represented by the expression $(A + B) \times C$.

Example 2:

P AND the result of Q AND R is represented by the expression P & (Q & R).

NOTE — If it is desired to distinguish the case in which there are more than two operands for an operator, the phrase ‘ distributed infix notation ’ may be used.

9.2 Prefix Notation/Polish Notation/Parenthesis-Free Notation/ Lukasiewicz Notation — A method of forming mathematical expressions in which each operator precedes its operands and indicates the operation to be performed on the operands or the intermediate results that follow it.

Example 1:

A added to B and the sum multiplied by C is represented by the expression $x + ABC$.

Exomple 2:

P AND the result of Q AND R is represented by the expression & P&QR.

9.3 Postfix Notation/Suffix Notation/Reverse Polish Notation. — A method of forming mathematical expressions in which each operator is preceded by its operands and indicates the operation to be performed on the operands or the intermediate results that precede it.

Example 1:

A added to B and the sum multiplied by C is represented by the expression $AB + Cx$.

Example 2:

P AND the result of Q AND R is represented by the expression $PQR\&\&$.

10. PROCESSING OF NUMBERS AND QUANTITIES

10.1 To Normalize (in a Floating-Point Representation System)/ To Standardize — To make an adjustment to the fixed-point part and the corresponding adjustment to the exponent in a floating-point representation to ensure that the fixed-point part lies within some prescribed range, the real number represented remaining unchanged.

Example:

In order to bring the fixed-point part into the range 1 to 9·99...the floating-point representation $123\,45 \times 10^2$ may be normalized to $1{\cdot}234\,5 \times 10^4$.

10.2 Truncation (of a String)

a) The deletion or omission of a leading or of a trailing portion of a string in accordance with specified criteria.

b) The termination of a computation process, before its final conclusion or natural termination, if any, in accordance with specified rules.

10.3 To Round — To delete or omit one or more of the least significant digits in a positional representation and to adjust the part retained in accordance with some specified rule.

NOTE 1 — The purpose of rounding is usually to limit the precision of the numeral or to reduce the number of characters in the numeral, or to do both these things.

NOTE 2 — The most common arithmetic forms of rounding are rounding down, rounding up and rounding off.

10.4 To Round Down — To round, making no adjustment to the part of the numeral that is retained.

Example:

The numerals 12·637 4 and 15·062 5, when rounded down to two decimal places, become 12·63 and 15·06 respectively.

NOTE 1 — If a numeral is rounded down, its absolute value is not increased.

NOTE 2 — Rounding down is a form of truncation.

10.5 To Round Up — To round, adjusting the part of the numeral that is retained by adding 1 to the least significant of its digits and executing any necessary carries, if and only if one or more non-zero digits have been deleted.

Example:

The numerals 12·637 4 and 15·062 5, when rounded up to two decimal places, become 12·64 and 15·07, respectively.

NOTE — If a numeral is rounded up, its absolute value is not decreased.

10.6 To Round Off

a) To round, adjusting the part of the numeral retained by adding 1 to the least significant of its digits and executing any necessary carries, if and only if the most significant of the digits deleted was equal to or greater than half the radix of its digit place.

Example:

The numerals 12·637 5 and 15·062 5, when rounded off to two decimal places, become 12·64 and 15·06 respectively.

b) To round, adjusting the part of the numeral retained by adding one to the least significant of its digits and executing any necessary carries, if:

1) the most significant of the digits deleted was greater than half the radix of that digit place;

2) the most significant of the digits deleted was equal to half the radix and one or more of the following digits were greater than zero;

3) the most significant of the digits deleted was equal to half the radix, all the following digits were equal to zero, and the least significant of the digits retained was odd.

Example:

The numerals 12·637 5 and 15·062 5, when rounded off to three decimal places, become 12·638 and 15·062, respectively.

NOTE — In this definition, even may be substituted for odd.

10.7 To Scale/To Normalize — To change the representation of a quantity, expressing it in other units, so that its range is brought within a specified range.

10.8 Scale Factor/Scaling Factor — A number used as a multiplier in scaling.

Example:

A scale factor of 1/1 000 would be suitable to scale the values 856, 432, -95 and -182 to lie in the range -1 to $+1$ inclusive.

10.9 To Quantize — To divide the range of a variable into a finite number of non-overlapping intervals that are not necessarily of equal width, and to designate each interval by an assigned value within the interval.

Example:

A person's age is for many purposes quantized with a quantum (interval) of 1 year.

10.10 To Sample — To obtain the values of a function for regularly or irregularly spaced distinct values from its domain.

NOTE — Other meanings of this term may be used in particular fields, for example, in statistics.

11. OPERATIONS — GENERAL TERMS

11.1 Operation — A well-defined action that, when applied to any permissible combination of known entities, produces a new entity.

Example:

The process of addition in arithmetic; in adding five and three and obtaining eight, the numbers five and three are the operands, the number eight is the result, and the plus sign is the operator indicating that the operation performed is addition.

11.2 Operand — An entity on which an operation is performed.

11.3 Result — An entity produced by the performance of an operation.

11.4 Monadic Operation/Unary Operation — An operation on one and only one operand (*see* Appendix A).

Example:

Negation.

11.5 Dyadic (*N*-Adic) Operation/Binary (*N*-Ary) Operation — An operation on two and only two (on *N* and only *N*) operands (*see* Appendix B).

NOTE — The term binary operation is deprecated to avoid confusion with binary arithmetic operation and with Boolean operation.

11.6 Operator (in Symbols Manipulation) — A symbol that represents the action to be performed in an operation.

11.7 Monadic (Dyadic) Operator/Unary (Binary) Operator — An operator that represents an operation on one and only one operand (on two and only two operands).

11.8 Logic Operation/Logical Operation

a) An operation that follows the rules of symbolic logic.

b) Any operation in which each character of the result depends only on the corresponding character of each operand.

Example:

The dyadic Boolean operations given in the column 'result for' in Appendix A.

11.9 Threshold Operation — An operation that evaluates the threshold function of its operands.

11.10 Majority Operation — A threshold operation in which each of the operands may take only the values 0 and 1, and that takes the value 1 if and only if the number of operands having the value 1 is greater than the number of operands that have the value zero.

11.11 To Compare — To examine two items to discover their relative magnitudes, their relative positions in an order or in a sequence, or whether they are identical in given characteristics.

11.12 Logical Comparison — The examination of two strings to discover if they are identical.

12. SHIFTS

12.1 Shift — The movement of some or all of the characters of a word each by the same number of character places in the direction of a specified end of the word.

12.2 Arithmetic Shift — A shift, applied to the representation of a number in a fixed radix numeration system and in a fixed-point representation system, in which only the characters representing the fixed point part of the number are moved.

NOTE 1 — An arithmetic shift is usually equivalent to multiplying the number by a positive or a negative integral power of the radix, except for the effect of any rounding.

NOTE 2 — Compare the logical shift with the arithmetic shift, especially in the case of floating-point representation.

12.3 Logical Shift/Logic Shift — A shift that equally affects all the characters of computer word.

12.4 End-Around Shift/Cyclic Shift — A logical shift in which the characters moved out of one end of a computer word or register are re-entered into the other end.

13. TABLES AND DIAGRAMS

13.1 Operation Table — A table that defines an operation by listing all appropriate combinations of values of the operands and indicating the result for each of these combinations.

13.2 Boolean Operation Table — An operation table in which each of the operands and the result take one of two values.

13.3 Truth Table — An operation table for a logic operation.

13.4 Venn Diagram — A diagram in which sets are represented by regions drawn on a surface.

13.5 Veitch Diagram — A means of representing Boolean functions in which the number of variables determines the number of squares in the diagram; the number of squares needed is the number of possible states, that is two, raised to a power determined by the number of variables.

13.6 Karnaugh Map — A rectangular diagram of a logic function of variables drawn with overlapping sub-rectangles such that each intersection of overlapping rectangles represents a unique combination of the logic variables and such that an intersection is shown for all combinations.

14. ADDITIONAL TERMS

14.0 These terms do not belong properly to the data processing field.

14.1 Set — A finite or infinite number of objects of any kind, of entities, or of concepts, that have a given property or properties in common.

14.2 Element (of a Set)/Member (of a Set) — An object, entity or concept having the properties that define a set.

14.3 Empty Set/Null Set — A set that has no elements.

14.4 Subset — A set each element of which is an element of a specified other set.

14.5 Proper Subset — Of a set, a subset that does not include all the elements of the set.

14.6 Universal Set — The set that includes all the elements of concern in a given study.

14.7 Combination — A given number of different elements selected from a set without regard to the order in which the selected elements are arranged.

14.8 Permutation — An ordered arrangement of a given number of different elements selected from a set.

14.9 Variable — An entity whose value may be indeterminate, or indeterminate between known limits, until an actual value is assigned to it in a given application.

14.10 To Range — To set values that a quantity or function may take.

14.11 Function — A mathematical entity whose value, that is, the value of the dependent variable, depends in a specified manner on the values of one or more independent variables, not more than one value of the dependent variable corresponding to each permissible combination of values from the respective ranges of the independent variables.

14.12 Recursive Function — A function whose values are natural numbers and are derived from natural numbers by substitution formulae in which the function is an operand.

14.13 Arithmetic Operation — An operation that follows the rules of arithmetic.

14.14 Augend — In an addition operation, a number or quantity to which numbers or quantities are added.

14.15 Addend — In an addition operation, a number or a quantity added to the augend.

14.16 Sum — The number or quantity that is the result of the addition of two or more numbers or quantities.

14.17 Minuend — In a subtraction operation, the number or quantity from which another number or quantity is subtracted.

14.18 Subtrahend — In a subtraction operation, the number or quantity subtracted from the minuend.

14.19 Difference — In a subtraction operation, the number or quantity that is the result of subtracting the subtrahend from the minuend.

14.20 Factor — In a multiplication operation, any of the numbers or quantities that are the operands.

14.21 Multiplicand — In a multiplication operation, the factor that is multiplied by another number or quantity.

14.22 Multiplier Factor/Multiplier — In a multiplication operation, the factor by which the multiplicand is multiplied.

14.23 Product — The number or quantity that is the result of a multiplication operation.

14.24 Dividend — In a division operation, the number or quantity to be divided.

14.25 Divisor — In a division operation, the number or quantity by which the dividend is divided.

14.26 Quotient — The number or qnantity that is the value of the dividend divided by the value of the divisor and that is one of the results of a division operation.

14.27 Remainder — In a division operation, the number or quantity that is the undivided part of the dividend, having an absolute value less than the absolute value of the divisor, and that is one of the results of a division operation.

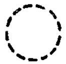
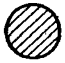
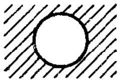
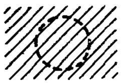
14.28 Union Set — The collection of the elements of two or more sets.

14.29 Intersection Set — The collection of the common elements of two or more sets.

APPENDIX A

[*Clauses* 11.4 *and* 11.8(b)]

TABLE OF MONADIC BOOLEAN OPERATIONS

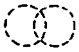
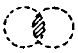
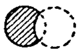
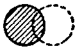
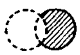
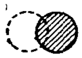
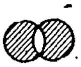
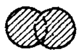
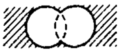
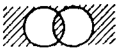
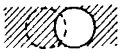
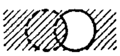
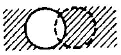
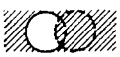
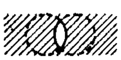
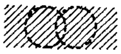
Operation Number	Complementary Operation	Result for		Entry Article	Meaning Signification	Examples for Representation		Clause Number
		$P = 0$	$P = 1$			Symbolic Representation	Representation Using	
0	3	0	0	zero constant	zero constant	0		—
1	2	0	1	variable	P P			—
2	1	1	0	negation	not P	—		6.16
3	0	1	1	one constant	one constant	1		—

Note — The variable *P* is represented by the circle. The defined set is represented by the shaded areas.

APPENDIX B

(*Clause* 11.5)

TABLE OF DYADIC BOOLEAN OPERATIONS

OPERATION NUMBER	COMPLEMENTARY OPERATION	RESULT FOR				ENTRY	MEASURING	EXAMPLES FOR REPRESENTATION		ENTRY NUMBER
		$P=0$ $Q=0$	$P=0$ $Q=1$	$P=1$ $Q=0$	$P=1$ $Q=1$			Symbolic Representation	Representation Using Venn Diagram	
0	15	0	0	0	0	zero constant	zero constant	0		–
1	14	0	0	0	1	conjunction	P and Q	∧		6.10
2	13	0	0	1	0	exclusion	P excluding Q	↛		6.14
3	12	0	0	1	1	(first) variable	P			–
4	11	0	1	0	0	exclusion	Q excluding P	↛		6.14
5	10	0	1	0	1	(second) variable	Q			–
6	9	0	1	1	0	non-equivalence	either P or Q	≢		6.9
7	8	0	1	1	1	disjunction	P or Q	∨		6.12
8	7	1	0	0	0	non-disjunction	neither P nor Q	⊽ ↓		6.13
9	6	1	0	0	1	equivalence operation	P equivalent to Q	≡		6.8
10	5	1	0	1	0	negation of second variable	not Q	—		–
11	4	1	0	1	1	implication	Q implies P	→		6.15
12	3	1	1	0	0	negation of first variable	not P	–		–
13	2	1	1	0	1	implication	P implies Q	→		6.15
14	1	1	1	1	0	non-conjunction	not both P and Q	⊼ ↑		6.11
15	0	1	1	1	1	one constant	one constant	1		–

NOTE — The variables P and Q are represented respectively by the left circles and by the right circles of this table. The defined set is represented by the shaded areas.

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